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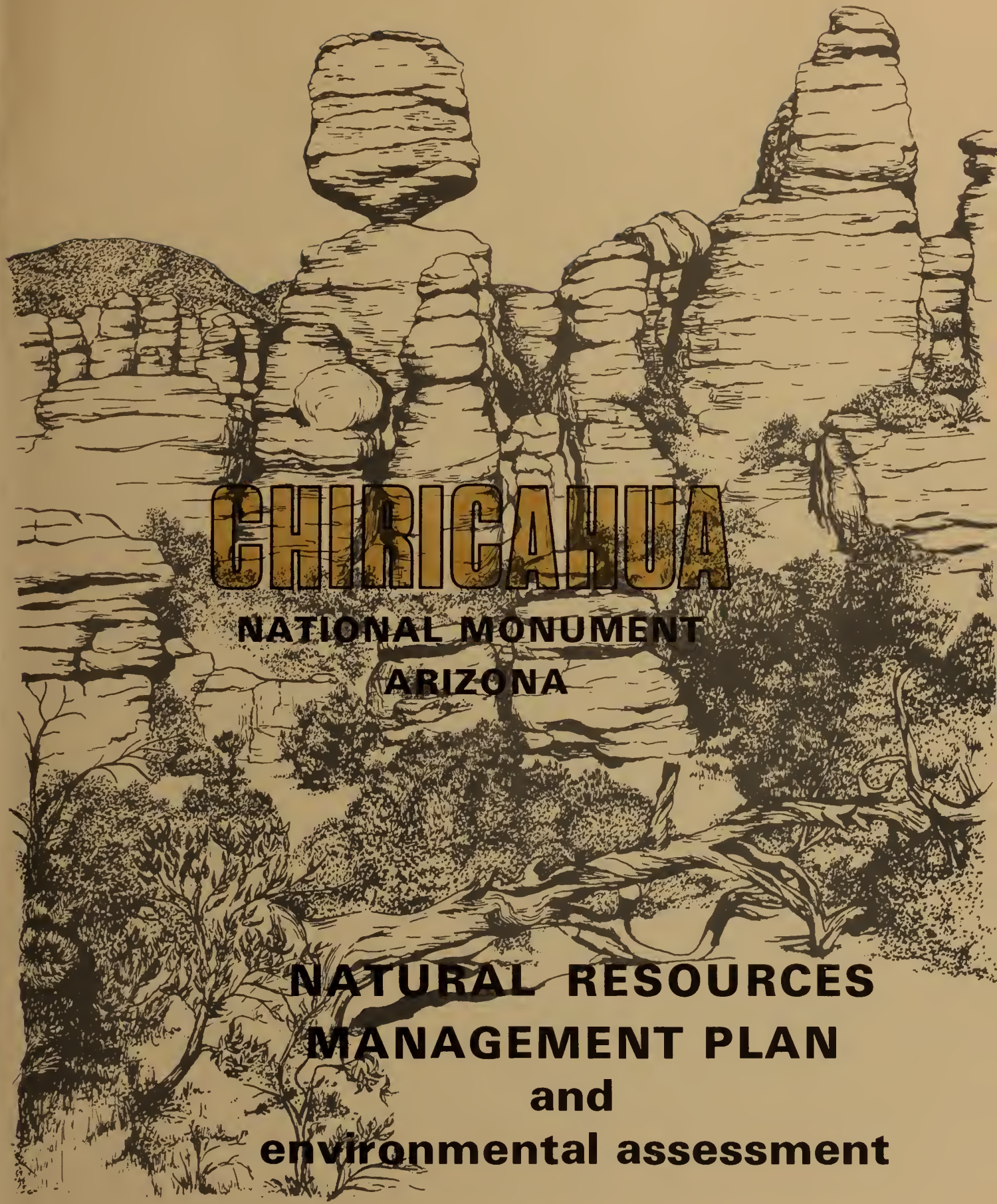

CHIRICAHUA

NATIONAL MONUMENT

ARIZONA

NATURAL RESOURCES MANAGEMENT PLAN and environmental assessment

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

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NATURAL RESOURCES MANAGEMENT PLAN
and Environmental Assessment

CHIRICAHUA NATIONAL MONUMENT

ARIZONA

Prepared by
Chiricahua National Monument

National Park Service
Department of the Interior

February 1980

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ABSTRACT

The Natural Resources Management Plan for Chiricahua National Monument outlines and directs action for the management of natural resources. The plan is a composite of management objectives and proposed research and management actions which will provide for the perpetuation, restoration, and protection of Chiricahua's natural resources in an environment where all natural processes are allowed to exert their influences.

Management actions are proposed in order to reverse natural resources deterioration resulting from a complex of factors and include Natural Resource Monitoring, Fencing of Boundaries, Construction of Trails, Closure and Rehabilitation of Heavy Use Areas, Site Management With Native Plant Species, Management of Endangered and Threatened Species, and Fire Management.

Research actions are proposed to provide a data base concerning those biotic and abiotic factors which comprise, shape and sustain park ecosystems. Research actions include Air Quality Monitoring, Hydrology Research, Soils Research, Fire Ecology Research, Endangered Species Research and Natural Resources Basic Inventory. Other research may be included in the management actions where information is needed for the proper implementation of those management actions.

TABLE OF CONTENTS

	Page
LIST OF FIGURES	1
ENVIRONMENTAL REVIEW	2
NATURAL RESOURCES MANAGEMENT PLAN	4
INTRODUCTION	4
LEGISLATIVE BACKGROUND FOR THE NATURAL RESOURCES MANAGEMENT PLAN	4
MANAGEMENT OBJECTIVES	5
NATURAL RESOURCES MANAGEMENT AND RESEARCH ACTIONS	5
MANAGEMENT ACTIONS	7
RESEARCH ACTIONS	11
RELATIONSHIP OF THE PROPOSAL TO OTHER PROJECTS AND PLANS	14
ENVIRONMENTAL ASSESSMENT	15
DESCRIPTION OF THE ENVIRONMENT	15
GEOGRAPHY	15
CLIMATE	15
GEOLOGY	17
VEGETATION	19
SOILS	25
HYDROLOGY	25
AIR	27
WILDLIFE	28
LAND CLASSIFICATION	29
ARCHAEOLOGY, ETHNOLOGY, HISTORY AND PALEONTOLOGY	31
VISITOR USE AND FACILITIES	35
REGIONAL INFLUENCES	35
PROBABLE FUTURE ENVIRONMENT WITHOUT THE PROPOSAL	37
ENVIRONMENTAL IMPACTS OF PROPOSED ACTIONS	39
MITIGATING MEASURES INCLUDED IN PROPOSED ACTIONS	43
ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED	45

Page

THE RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY 46

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN PROPOSED ACTIONS SHOULD THEY BE IMPLEMENTED 47

ALTERNATIVES TO PROPOSED ACTIONS 48

CONSULTATION AND COORDINATION 50

LITERATURE CITED 51

LIST OF FIGURES

		Page
Fig. 1	Regional map: Chiricahua National Monument	3
Fig. 2	Location map: Chiricahua National Monument	6
Fig. 3	Average monthly distribution of precipitation in Chiricahua National Monument	16
Fig. 4	Geologic map of Chiricahua National Monument	18
Fig. 5	Vegetation map of Chiricahua National Monument	23
Fig. 6	Research natural area map: Chiricahua National Monument	24
Fig. 7	Generalized canyon topography in Chiricahua National Monument	26
Fig. 8	Land Classification in Chiricahua National Monument	30

ENVIRONMENTAL REVIEW

The Natural Resources Management Plan for Chiricahua National Monument presents an action program necessary for the long-term management of the monument's natural resources. The environmental assessment, which accompanies the plan, describes major components of the environment and discusses those impacts, alternatives, and mitigating measures involved with natural resource management actions. The ultimate objective of the plan is to provide for the preservation and perpetuation of Chiricahua's natural resources.

Proposed management actions involving resource monitoring, trail construction, rehabilitation of heavy use areas, fencing, and revegetation will assist in reversing areas of natural resource deterioration. Research actions will provide data necessary for a more thorough understanding of the living and non-living components of the monument's ecosystems.

Each proposed action was selected from a list of alternatives. Those alternatives which met the criteria of being most beneficial to natural resources without adverse environmental impacts were proposed as the desired management actions.

Since none of the proposed actions will have significant or adverse environmental impacts and will not involve irreversible commitment of natural resources, it is recommended that the Natural Resources Management Plan for Chiricahua National Monument be assigned a Negative Declaration. Environmental impact statements for proposed management actions will not be prepared unless public controversy or other factors indicate a need for those documents.

The Natural Resources Management Plan for Chiricahua National Monument will become an action program after the 30-day public review period has ended.

8/10/79
Date

Superintendent, Chiricahua National Monument

11/6/79
Date

Regional Director, Western Region

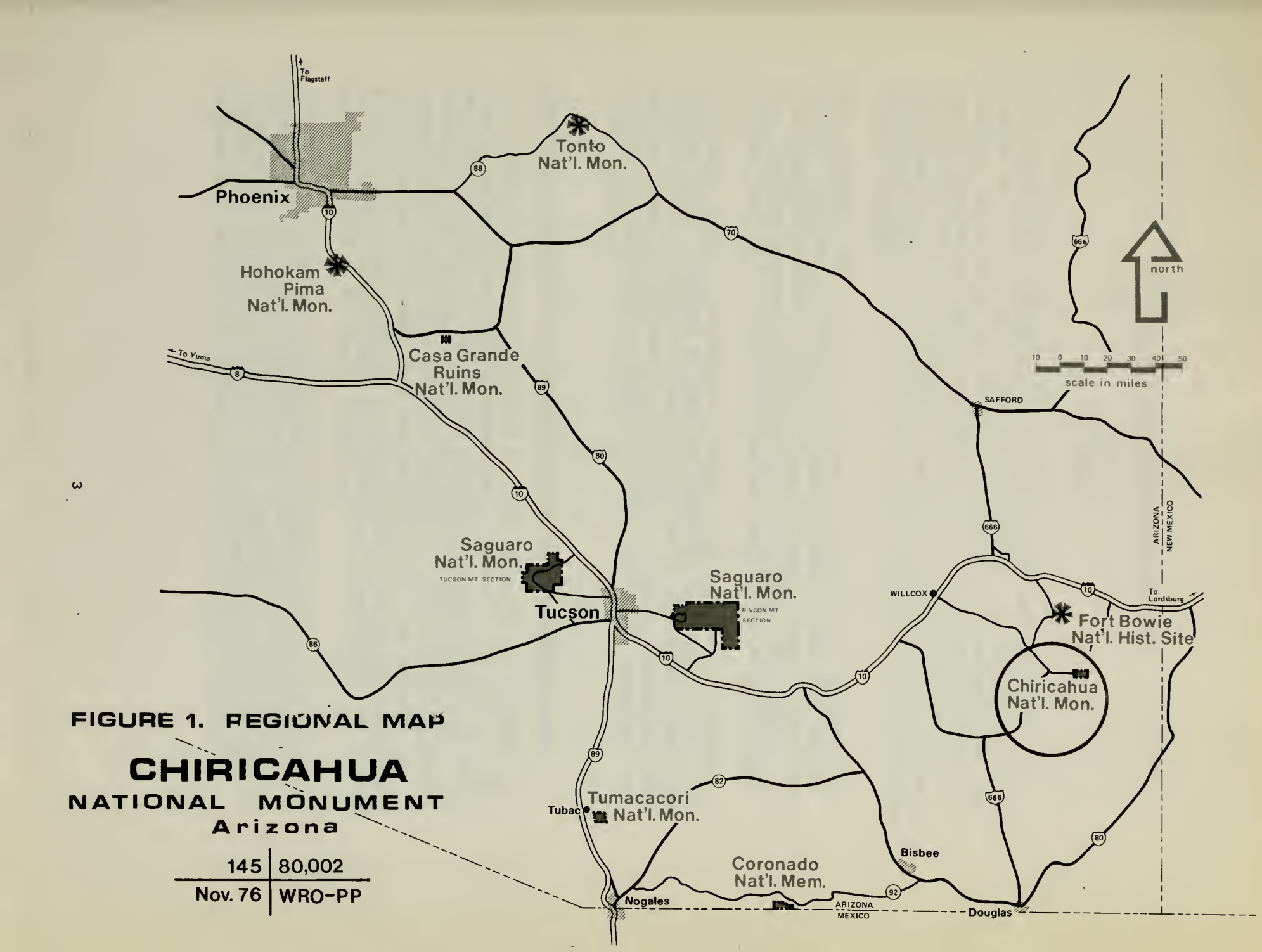

FIGURE 1. REGIONAL MAP

CHIRICAHUA
NATIONAL MONUMENT
Arizona

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NATURAL RESOURCES MANAGEMENT PLAN

INTRODUCTION

Chiricahua National Monument was established on April 18, 1924. The purpose of the area is "To preserve the scenery, the natural and historic objects, the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for enjoyment of future generations." To satisfy that purpose, and in accordance with the National Environmental Policy Act of 1969, the National Park Service proposes a Natural Resources Management Plan for Chiricahua National Monument.

The purpose of this plan is to provide a system for the management of natural resources in Chiricahua National Monument. The plan and its environmental assessment identify areas of natural resource deterioration, outline research needs, and present management and research actions designed to correct deficiencies and provide needed research.

Chiricahua National Monument is located in the Chiricahua Mountains, Cochise County, Southern Arizona, and contains 10,646 acres. The area was set aside primarily for the preservation of its geologic landforms. In time, however, the mountain environment, wildlife, vegetation, and relative isolation from the impacts of man also became recognized as prime resources.

LEGISLATIVE BACKGROUND FOR THE NATURAL RESOURCES MANAGEMENT PLAN

The mission of Chiricahua National Monument is stated directly by several documents and guided somewhat more indirectly by others. The enabling proclamation creating the monument was signed April 18, 1924, pursuant to the "Antiquities Act" and set aside 4,287 acres for protection as "Chiricahua National Monument". A second proclamation dated June 10, 1938, more than doubled the size of the monument and placed it under the direction of the National Park Service Organic Act of 1916, making the provision for protection, preservation, and enjoyment applicable to the entire 10,646 acres.

The primary mission of the monument has changed little since 1924, however, several legislative documents have created or modified policies and objectives related to the management, protection and preservation of natural resources. The wilderness act of 1964 recognized the importance of wilderness values and enabled congress to

designate 9,440 acres of Chiricahua as wilderness in 1976. The Endangered Species Act and Environmental Policy Act in 1969 placed new demands on management and provided for the identification and protection of the monument's endangered or threatened plants and animals. The Clean Air Act, as Amended August 1977, recognized that the nation's air resources were in a state of decline and designated the wilderness zone of Chiricahua as a Class I Area where significant deterioration of air quality is to be prohibited.

MANAGEMENT OBJECTIVES

The management objectives of the Natural Resources Management Plan are as follows:

1. To insure the preservation and perpetuation of the monument's natural resources.

2. To provide for the perception, appreciation, and enjoyment of the natural resources while maintaining the unimpaired quality of those resources.

3. To plan for regulated means by which the visitor can have a meaningful encounter with the resources in the face of increasingly heavy visitor use.

4. To plan for an on-going program of research and data collection that will provide management with the information necessary for intelligent management of the area's natural resources.

5. To carry out a program for the restoration of flora in all of the monument's heavy use areas.

6. To provide a guide for the proper management of Chiricahua's natural resources and create a management program with the overall objective of allowing natural processes to occur without interference by man.

NATURAL RESOURCE MANAGEMENT AND RESEARCH ACTIONS

An assessment was made, in conjunction with the establishment of the Natural Resource Monitoring System by Dr. Will Moir, of Chiricahua's natural resource conditions in 1973 and 1974. He also evaluated the park's natural resources management program. He found, in general, the monument's natural resources to be in satisfactory condition,

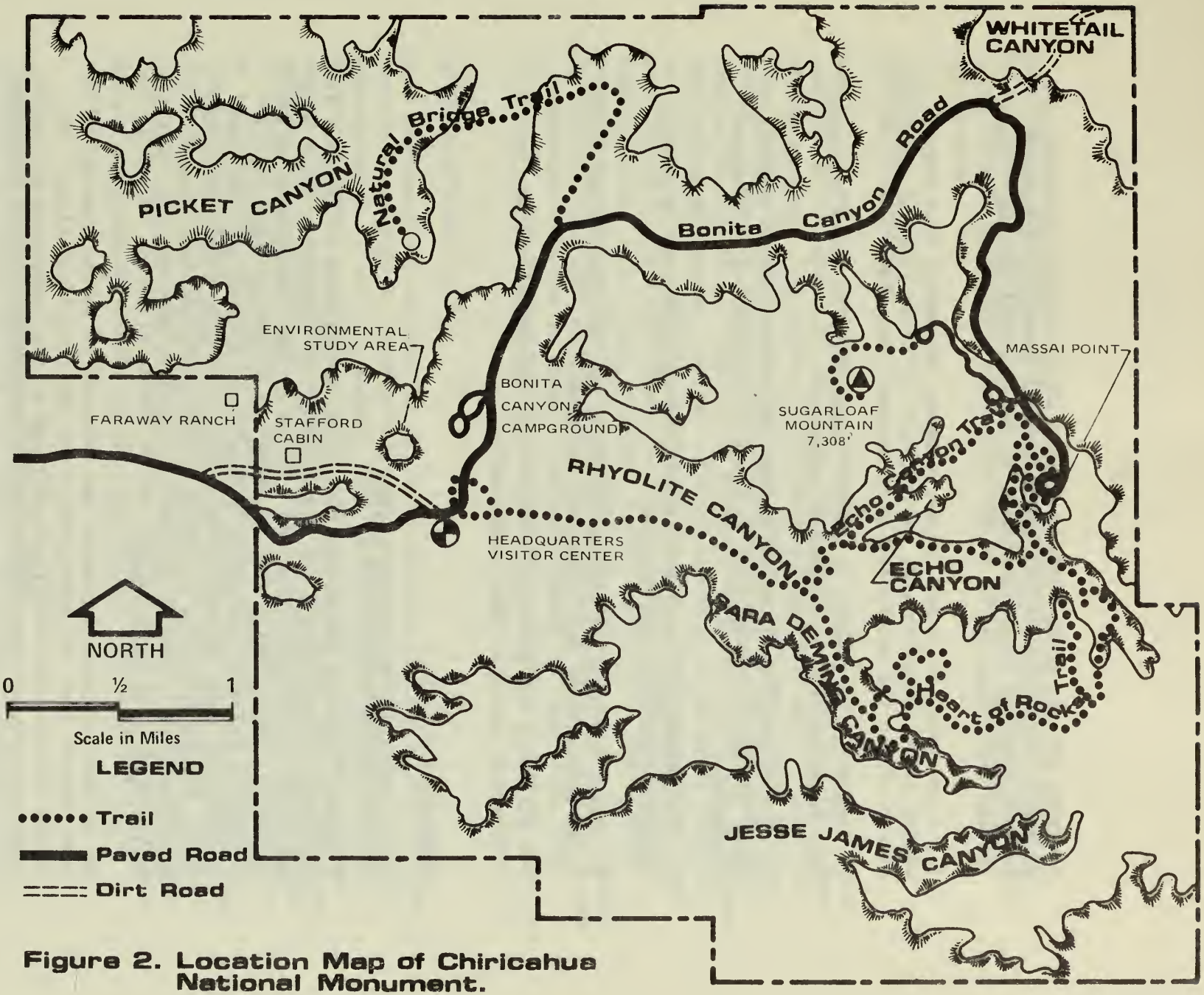

Figure 2. Location Map of Chiricahua National Monument.

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however, several areas were identified where natural resources were altered. Evaluation of the area's natural resources management program resulted in the discovery of several inadequacies. These include the following:

1. A few localized areas in the monument had and/or were experiencing heavy, uncontrolled, visitor use, or other types of use which brought about the deterioration of natural resources.

2. There was an absence of control, especially in heavy use areas, over known adverse environmental impacts.

3. The natural resources management program had failed to allow a major natural process, fire, to exert its influences on monument ecosystems.

4. Park management had insufficient quantitative data on natural resource conditions and trends.

5. Basic knowledge of the components of park ecosystems and their interrelationships was incomplete or absent.

The following categories of research and management actions are proposed to correct these inadequacies:

MANAGEMENT ACTIONS

Natural Resource Monitoring System

A natural resource monitoring system was established in March of 1974 to quantitatively assess the condition of the monument's vegetation and soils in selected locations. Prior to this, management relied on subjective visual means for assessing the trend and condition of vegetative and soil resources. These early methods may have been satisfactory when visitor use was light, but they lacked the sensitivity needed for early detection of deteriorating conditions. Anticipated increases in visitor use requires more precise, quantitative methods of measurement.

The current monitoring program was designed to obtain timely, quantitative data and photographic records from field plots. The system can evaluate existing conditions of the vegetation and soils; identify areas of high visitor and/or maintenance impact; determine with increasing precision the visitor use capacity of each management zone; and provide early warning of declining vegetation and soil resource conditions.

Maintenance, monitoring, and analysis of the program will be conducted by the monument staff and/or outside professional personnel. Additional field methods of resource monitoring may be added to the system when appropriate.

Fencing of Boundaries

Cattle grazing has resulted in alteration of vegetation composition and density, soil compaction, and increased erosion in a few localized areas of the monument. Two miles of the northwest boundary and 1.5 miles of the southeast boundary were fenced in 1974 and 1975 and trepass grazing ended. At present, fences exist along all fronts of the monument where grazing is permitted. However, if Coronado National Forest should expand its grazing allotments, several unfenced sections of the park, approximately five miles, could be exposed to grazing. These vulnerable areas will be fenced, as funds become available, before damage occurs rather than after the fact. Belt transects were established in those areas recently excluded to grazing to measure vegetation recovery. The results of recovery rate data obtained from them was encouraging, since there was a measurable increase in canopy coverage, vegetation basal area, and density of grass species within one year after closure to trepass grazing.

Construction of Trails

This management action and the two which follow are interrelated actions proposed to reduce or eliminate natural resource deterioration. A trail, approximately 0.5 mile in length, will be constructed around the campground periphery to confine visitor use to manageable channels, reduce random travel, and reverse deterioration of vegetation and soil resources. Engineering considerations will aim both to satisfy visitor desires and to minimize adverse impacts on resources due to heavy use. In addition to covering the periphery of the campground, the periphery trail will connect with trails leading to other locations such as the Environmental Study Area and the Stafford Cabin. Vegetation restoration and rehabilitation of the campground periphery zone will enhance visitor experience and create the desire to remain on the trail. Maintained trail surfaces will also reduce amount of random cross country travel to points of interest.

Closure and Rehabilitation of Heavy Use Areas

Human use in several areas of the monument has eliminated or altered vegetation. Several abandoned dirt roads, left over from occupation

by the Civilian Conservation Corps and the Silver Spur Guest Ranch were closed to vehicles for the past few years, but scars remain. Road scars total about two miles and recovery of vegetation is not evident. In addition, the 37-site Bonita Canyon Campground receives heavy use, approximately 11,000 campers per year, and vegetation is declining. Research, designed to provide data regarding recovery rate for vegetation is underway in the campground. Results indicate recovery rates are slow. If degree of soil compaction is not reduced, plants will not recover.

More data are needed, but enough exists from studies conducted in similar Forest Service areas and the park to demonstrate that a system of campsite closure, combined with seeding, mulching, and irrigation, effectively reverses the present trend. During spring and summer in 1977, six campground sites were closed and subjected to the above treatment. Future of the program will depend upon success of the 1977 program. Total recovery of vegetation is not expected, but evidence of definite reversal of present conditions will be used as the criterion for continuation of the closure system of management. The objective of the closure system will be to provide an environment which will allow plant communities to sustain themselves in the presence of continued public use.

Previously mentioned road scars will be treated in the same manner as the campground. Roads are no longer used and recovery rates of vegetation are expected to be greater on them than at campsites where heavy public use will continue.

Site Management with Native Plant Species

Native plants will be used to assist in the restoration of flora in heavy use areas of the park. This program will consist of the following elements: (1) Intensive seed collection from sources within the monument. Seeds will be stored and properly labeled to include source and date of collection. (2) Preparation of seedbeds including mulching with litter or rocks, supplemental watering, and erosion control. (3) Site management and continued maintenance of seeded locations until vegetation is well established. This will often call erection of temporary and/or permanent exclosures and the redirection of visitor use patterns.

Fire Ecology and Management

The presence or absence of natural fire is an ecological factor which shapes, perpetuates, and sustains plants and animals native to an ecosystem.

Fire has been excluded totally at Chiricahua for the past 40 years and studies related to fire history and ecology indicate that fire exclusion has resulted in unnatural changes to the monument's environment.

Fires occurred for thousands of years at Chiricahua and most if not all of the monument's vegetation systems and their associated wildlife populations are either fire-influenced or fire-dependent. Absence of fire allows increased amounts of fuel to accumulate and permits tree crowns to close in and shade out many plants which support various species of wildlife. Some species of plants such as Ponderosa Pine depend on fire and fail to reproduce effectively without it. Other species, such as Mountain-mahogany (Cercocarpus montanus), Manzanita (Arctostaphylos pungens), and Silktassel (Garrya wrightii) overmature in the absence of fire. Overmaturity of these and other species results in lower nutritional value of leaves and stems, reduced palatability, an increase in crown height placing them out of reach for many animal species.

The last major fire, covering most of the monument, occurred between 1885-1890 (Jackson, 1970). However, fire history research indicates that large major fires of this type were probably infrequent and occurred only under rare or unusual conditions. Small fires which created a mosaic pattern of burn areas probably occurred most frequently. Small fires have averaged 1.6 per year for the past forty years.

Additional fire-related research is proposed to determine the extent of ecosystem alteration due to fire exclusion. Research results from natural and/or prescribed fires will be used to correct the problems caused by fire suppression. The monument will be divided into zones with natural boundaries selected to limit the extent of fires. Certain zones will be fire suppression areas, while others will allow natural or prescribed fires to occur under certain conditions. Where necessary, experimental plots may be burned to provide information related to fire behavior in various vegetation types.

A fire management plan will be drafted for the area and will direct management actions designed to return fire to the environment. The plan will follow basic guidelines presented in the Western Region Fire Plan.

Management of Endangered Species

Park management will provide for the identification, protection, and management of those species recognized as endangered or threatened by

Federal or State agencies. Endangered or threatened species of animals known either to exist within or to visit Chiricahua include the following: Peregrine Falcon, Falco peregrinus, and grey wolf, Canis lupus. In addition to endangered and threatened species, the following will also be identified and given special management attention if necessary:

1. Relict populations

2. Species existing at margin of their geographic range

3. Endemic species

4. Species rare or uncommon outside the monument but common within the monument.

5. Persecuted species (species under heavy hunting or trapping pressure) found in the monument. These persecuted species are exemplified by the mountain lion and coyote.

While those species included in the previous five categories may not be officially recognized as endangered or threatened, they deserve special management attention.

RESEARCH ACTIONS

Air Quality Monitoring System

The Clean Air Act as amended August 1977 designated Chiricahua as a Class I area where significant deterioration of air quality would not be allowed to occur. Air quality is and has been of great importance in the monument from the standpoint of enhancing scenic values and the management of natural resources. Air is a natural resource which affects every component of the area's ecosystems in some fashion and is essential in sustaining life as we know it.

Data relative to air quality conditions have never been collected in the monument so it is impossible to determine the extent or severity of declines in air quality at the present time. Air quality monitoring devices need to be installed in the near future to correct this situation and accumulate a data base which can provide baseline information concerning current air quality conditions. It is impossible for the monument to control the quality of air which originates outside park boundaries. However, the installation of air monitoring devices will be necessary to identify levels, kinds and, possibly sources of air

pollution. Data derived from these devices will also be valuable in future research concerning the effects of air pollution on vegetation and wildlife. Also, for other agencies such as Environmental Protection Agency to enforce edicts of the Clean Air Act, they require knowledge of any air pollution problems and accurate data to substantiate unacceptable declines in air quality in Chiricahua.

Vertebrate Inventory

Information concerning numbers and kinds of vertebrate species which occur in the monument is insufficient for interpretive or management efforts. Checklists of the area's mammals, birds, and reptiles are reasonably accurate, however, research aimed at producing an annotated inventory of vertebrates, including habitat preference and relative abundance (with special emphasis given to threatened or endangered species and their critical habitat) has never been conducted at Chiricahua. Therefore, a vital research project is proposed to correct the situation and provide adequate information concerning the monument's vertebrate fauna.

Soils Research

The monument's natural resource data base will continue to be incomplete without an adequate soils study and map. Future resource management and development planning will be inaccurate and/or incomplete without data of this type. A soil survey of the area is proposed to correct the situation. Soil types will be identified and a soils map compiled. Results of the soil survey will also be analyzed in conjunction with data from other management actions such as the Natural Resource Monitoring System and Fire Management.

Fire Ecology

Natural fires have exerted their influences on monument ecosystems for thousands of years. Plant and animal species either adapted to or underwent evolutionary alterations in response to powerful influences exerted by natural fires. Fire exclusion, consisting of a program of total suppression, has been management policy during the past forty-three years of the monument's history and has created problems related to vegetation, wildlife, and alterations to ecosystem processes. Extent and severity of these alterations is not understood. However, a fire history (1940-1976) and other on-site observations indicate that changes to vegetation types, relative to structure and distribution, may have been slight.

Service policy and management objectives have directed a return of natural fires, where possible, to park ecosystems. To accomplish this task, a fire management plan must be developed and carried out. The first step in the development of a fire management plan will call for determining where in the "fire cycle" major vegetation types are and to determine through tree-ring analysis the historic frequency of fire in selected vegetation types in the monument. This data is essential to the planning and conducting of a fire management plan which is long overdue at Chiricahua.

Endangered Species Research

Three species of wildlife (Peregrine Falcon, grey wolf, and jaguarundi) listed as endangered or threatened have been observed in Chiricahua over the last few years. Data concerning the distribution, population status, and critical habitat for these species does not exist at this time. Research is proposed to provide data necessary to protect, preserve, and properly manage endangered or threatened species in the Chiricahua area.

Basic Research Needs

Fauna: Information concerning the area's vertebrate fauna is incomplete. Research is proposed to provide additional information necessary to properly interpret and manage the monument's vertebrate fauna. Also, little is known about the monument's invertebrates. General invertebrate surveys will be directed toward identification. Research will be conducted on ecology of important species.

Flora: R. D. Roseberry and N. E. Dole in 1939 conducted a survey of plants in the monument, including photographs of major plant features and a vegetation type map. This first study of the monument's vegetation also provided information on composition of the area's major plant units. Tim Reeves of Arizona State University completed another study and reported it in Vegetation and Flora of Chiricahua National Monument in 1976. The park will continue plant studies as needs are identified. Special emphasis will be placed on the continuing identification of exotic, rare, and endemic plants in the area. Techniques will be developed and used to control or eliminate exotic species and to preserve native species.

RELATIONSHIP OF THE PROPOSAL TO OTHER PROJECTS AND PLANS

The Natural Resources Management Plan for Chiricahua is in keeping with those objectives set forth in the Statement for Management (1977), Wilderness Backcountry Use Plan (1974), and other Service and monument documents related to the management of natural resources.

The U.S. Forest Service is considering wilderness classification for those lands in Coronado National Forest which are adjacent to Chiricahua on the north, south, and east. Inclusion of these Forest Service lands in the wilderness system will enhance the management of Chiricahua's natural resources and provide greater harmony between management objectives of Coronado National Forest and Chiricahua National Monument.

A Phelps-Dodge Copper smelter is located 65 miles away southwest of the monument near Douglas, Arizona and gases emitted from this facility frequently affect air quality in the monument area. In addition, the Sulphur Springs Valley Electric Cooperative, Inc. has begun operation of a coal fired electric generating station, located approximately thirty-five miles west of the monument. Both of these installations could potentially lower air quality values in Chiricahua to a significant degree and create problems related to health, scenic values, and resource management.

ENVIRONMENTAL ASSESSMENT

DESCRIPTION OF THE ENVIRONMENT

GEOGRAPHY

Chiricahua National Monument is situated 70 miles north of Mexico in the Chiricahua Mountains of southeastern Arizona. It is 37 miles southeast of Willcox, Arizona, and can be reached from the north by Arizona 186, and from the south by Arizona 181. The park is composed of 10,646 acres and is bordered on three sides by Coronado National Forest and on the fourth side by private ranch land in the Sulphur Springs Valley.

Chiricahua is a natural area which derives its scenic beauty from outstanding erosional features in a forested mountain setting. The basic rock type, Rhyolitic Tuff, has been exposed to extensive fracturing, faulting, and erosion resulting in the formation of pinnacles, spires, balanced rocks, and isolated mesas.

The Chiricahua Mountains are located in the Basin and Range Biogeographical Province and are often referred to as "sky islands" in that they, and the flora associated with them, are separated from similar "islands" by expanses of grassland and desert averaging 10 to 40 miles in width. The Chiricahuas are not only "islands in a sea of grass" in the geographical sense, but also in the biotic sense.

Those sections of the Chiricahua Mountains contained within the monument boundaries display high relief ranging from 5,160 feet at the northwest corner to 7,365 feet near Whitetail Pass. Major drainages in the monument are through Pickett, Bonita, Rhyolite, and Jesse James Canyons. Permanent streams or lakes are not found within the monument.

CLIMATE

Climatic conditions follow a pattern of spring/fall drought, summer/winter precipitation. Air quality in the monument area is generally characterized by low levels of pollution, dust, and humidity which results in intense light and well over two-hundred days of sunshine per year.

General aspects of the climate at the monument have been summarized from data, during the inclusive period 1940-1973, collected at the park weather station. The mean precipitation during this period was 17.9

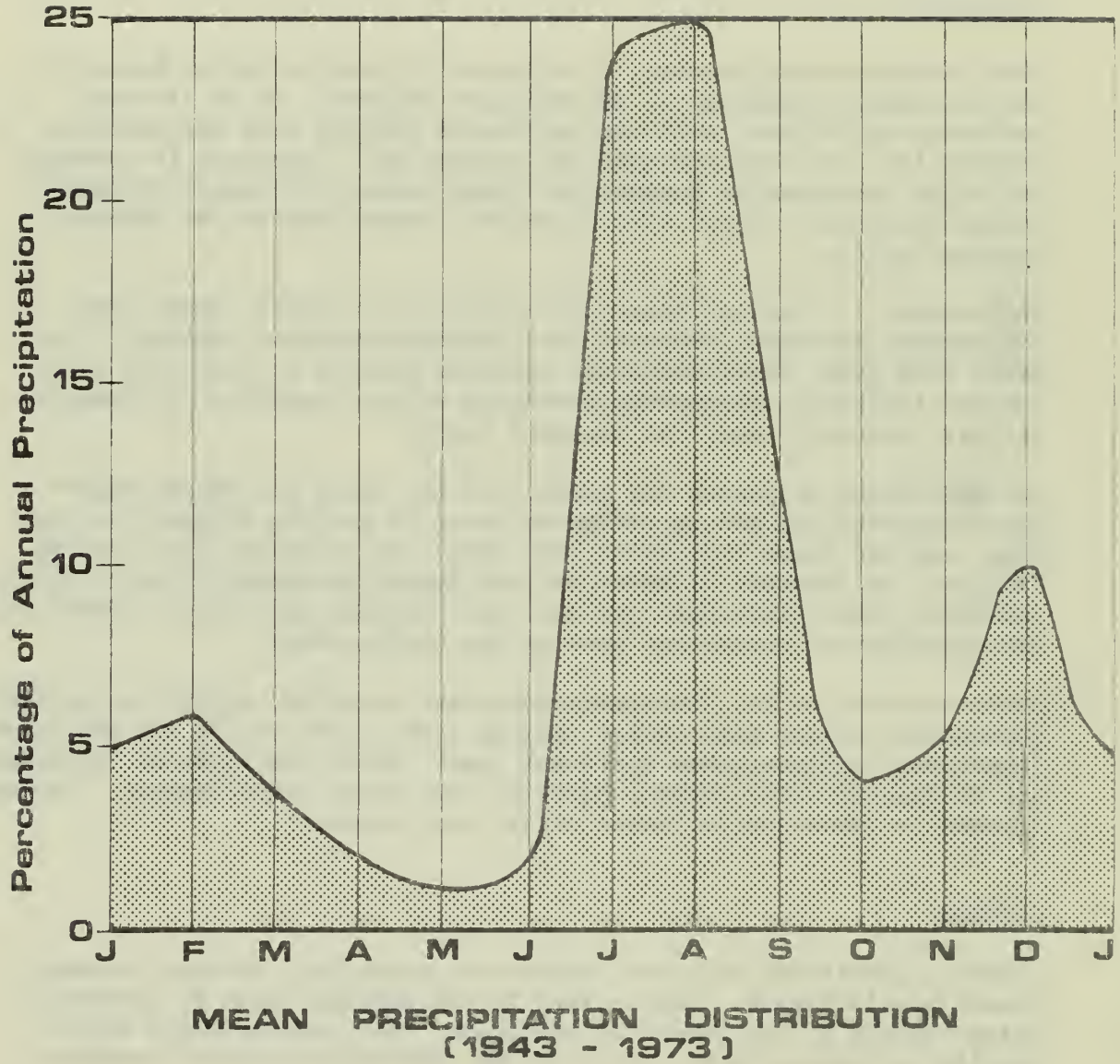

Figure 3. Average monthly distribution of precipitation in Chiricahua National Monument.
(The 12 monthly percentages total 100%.)

inches (455mm) with the wettest year, 1972, at 25.5 inches (648mm) and the driest, 1970, at 9.8 inches (259mm). Temperatures during the interval 1949-1973 inclusive were as follows:

yearly mean maximum	72.8°F (22.2°C)
yearly mean minimum	43.4°F (6.3°C)
hottest month-June	
mean maximum	89.5°F (31.9°C)
mean minimum	55.3°F (12.9°C)
coldest month-January	
mean maximum	55.4°F (13.0°C)
mean minimum	29.4°F (-0.9°C)

May and June are the warmest months and average approximately 2% of the year's precipitation, therefore severe moisture stresses are in effect for vegetation systems during this time of year. Summer convection storms with associated high winds, lightning, and hail are frequent during July and August. Snow is common from late fall through early spring and may remain in shaded north-facing canyons for long periods of time.

GEOLOGY

Chiricahua National Monument was set aside to preserve the unique rock formations located within it.

Prior to about 30 million years ago, the Chiricahua Mountain area consisted of volcanic sediments and sediments of water origin. Then, approximately 28 million years ago, a series of explosive volcanic events collectively termed "resurgent caldera" began to take place. The resurgent caldera was of the nuée ardente, or glowing clouds type, in which turbulent mixtures of expanding gases and fine ash emit from vents and pour down the mountain surface. The caldera responsible for the major rock formations of the monument (Rhyolite Canyon and Faraway Ranch Formations) is located to the south and is centered around Turkey Creek Canyon in Coronado National Forest.

Successive layers of hot ash from Turkey Creek Caldera gradually cooled and welded together in the form of rhyolite rock. Rock fractured along fault lines and joints to form blocks. Some blocks were uplifted while others remained in place, resulting in block-like columns, some of which are 150 feet high and 30 feet in diameter. In addition to the fault-block process, erosion factors such as wind, rain, and freezing eroded columns into spires, balanced rocks, and led to unusually shaped rocks for which the monument is well known.

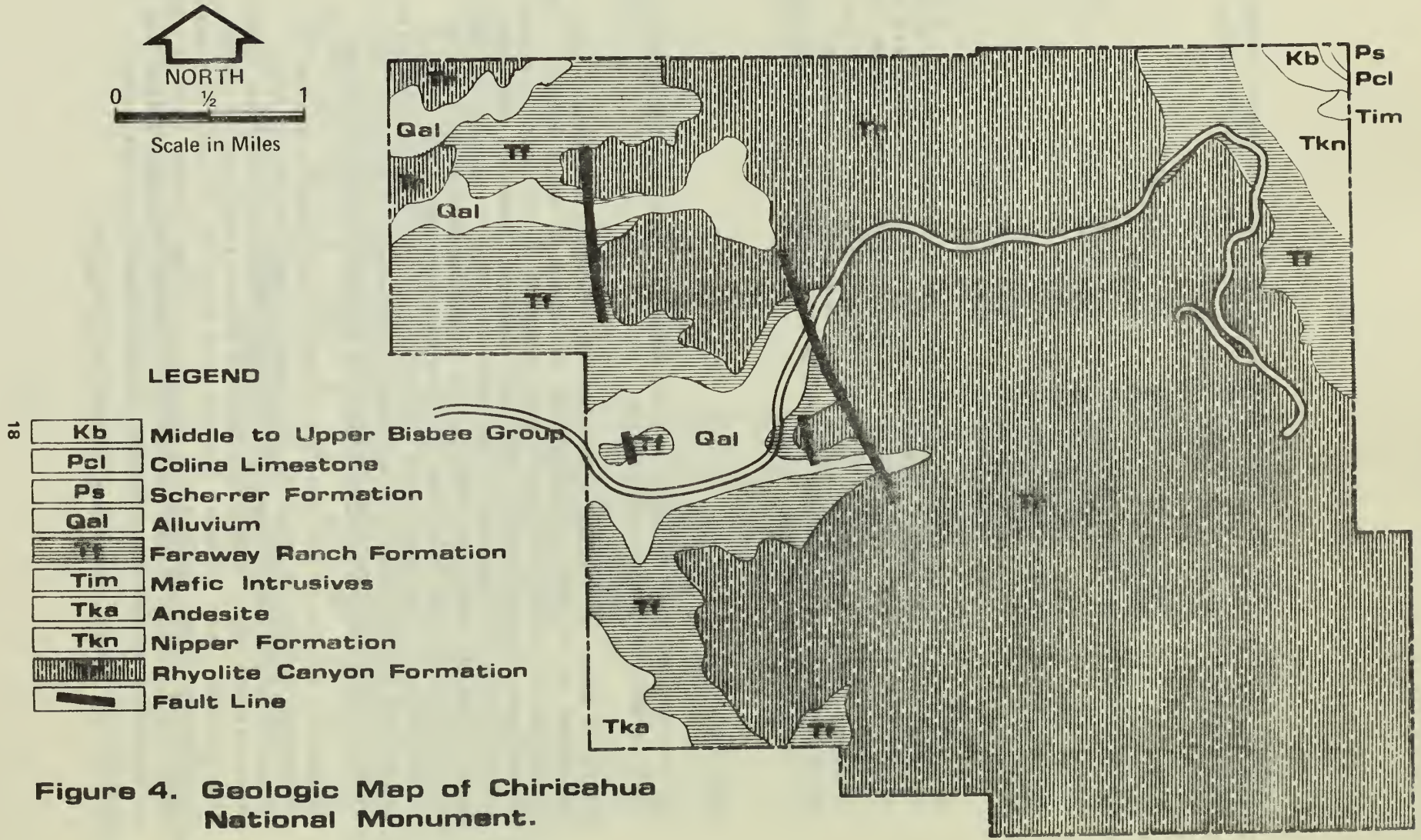

Figure 4. Geologic Map of Chiricahua National Monument.

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Those formations that outcrop in the monument, other than the predominant Rhyolite Canyon and Faraway Ranch Formations, are limited in occurrence (Sabins, 1957). Approximately 75% of the surface of the monument is covered by the Rhyolite Canyon Formation. The Faraway Ranch Formation is exposed only in the western portion of the monument (Fernandez and Enlows, 1966) and a narrow band across the northeastern corner of the monument.

A unique feature of Chiricahua National Monument, not directly related to the ash flow, is the ancient "lake bed" that is exposed in Bonita Canyon along the park road to Massai Point. This lake bed underlies the dominant Rhyolite Canyon Series and was exposed when the block fault tilted to the west leaving the eastern side upthrown.

These sedimentary deposits are conglomerates composed mostly of sandstones, siltstones, and tuffs which were collected during a period of seasonally humid climate. After short transport they were deposited in the shore zone of a permanent lake. No fossil evidence or organic remains of any kind have been found in these sediments.

VEGETATION

Chiricahua is floristically and physiognomically diverse. The monument's vegetative diversity is a reflection of many factors, among which are latitude, elevation, topography, soil composition, precipitation, climate, and natural fires (Reeves, 1976).

There are three important considerations in relation to the monument's flora: First, many species of plants, once distributed more widely in the region, are now restricted to the mountains. Approximately 10,000 years ago, climatic changes led to changes in plant distribution. Grasslands gradually replaced the oak-pine woodland, which then extended from the Sierra Madre in Mexico, restricting this woodland type to mountain slopes and washes. These mountains are now the northern limit of several species of "Mexican" oaks and pines. Second, higher elevations of the Chiricahuas serve as the southern limit of many plant species more common in northern latitudes. Finally, the Chiricahuas serve as a refuge for several endemic plant species.

The vegetation of the monument has been studied in considerable detail. Roseberry and Dole (1939) recognized twelve vegetation types in the monument. Reeves (1976), using the Brown and Lowe (1974) system of vegetation classification, recognized five Formation Types and ten Community Types. These Formations and their associated Community Types include the following:

Temperate Forest

Three types of temperate forest communities are found at Chiricahua. These types are Montane Conifer Forest, characterized by Douglas Fir and Ponderosa pine and found on mesic north facing canyons and uplands; Relict Conifer Forest, characterized by Arizona Cypress and found in low to mid-elevation canyon bottoms; and Deciduous Riparian Forest, characterized by walnut, sycamore, and ash, and found in the monument only in lower Bonita Canyon. The vegetation type map, included in the environmental assessment, shows the Montane and Relict Conifer Forest communities under the Mexican Oak-Pine Woodland Type.

Temperate Woodland

Approximately 65% of the monument is covered by woodland types (Roseberry and Dole, 1939). The two major community types are the Mexican Oak-Pine Woodland, characterized by Chihuahua pine, Piñon pine, Juniper, Arizona White oak, Palmer oak, and Net Leaf oak and the Encinal (Oak) Woodland, characterized by Emory oak, and Arizona White oak. The Mexican Oak-Pine Type is found throughout the monument depending upon slope and elevation. The Encinal (Oak) Woodland Type is restricted to open lower canyons and south facing slopes (Reeves, 1976).

Temperate Scrubland (Chaparral)

Two chaparral communities occur in the monument, the Evergreen Sclerophyll Community and the Mixed Shrub Community. Both of these community types are found throughout the monument and often form dense, nearly impenetrable thickets. The Evergreen Sclerophyll Type is characterized by Manzanita (Arctostaphylos pungens), and shrub oaks. Moir (1974) refers to this type as "dense to relatively open chaparral woodland vegetation typical of uplands and tablelands of rhyolite tuff in Chiricahua National Monument." The term chaparral-woodland denotes mixtures of vegetation types and much of the monument's vegetation is a mixture of woodland species and chaparral (Reeves, 1976). The Mixed Shrub Type is characterized by Desert Willow (Chilopsis linearis), Willow (Salix spp.), and Baccharis salicifolia and is found along West Whitetail Creek.

Temperate Grassland

Two grassland community types occur in the monument, the Gramma Grass-Scrub Community and the Mixed Grass-Scrub Community. The

Gramma Grass-Scrub Type is characterized by Blue Gramma (Bouteloua gracilis), and shrubs such as Prosopis glandulosa, Ericameria laricifolia, Baccharis pteronioides, Fallugia paradoxa, Mimosa biuncifera, Opuntia phaeacentha, and Lycium pallidum (Reeves, 1976). The Mixed Grass-Scrub Type is found primarily on south-facing slopes at lower elevations and is dominated by mixed grass species such as Bouteloua hirsuta, B. repens, Lycurus phleoides, and Schizachrium cirratum and shrub species such as Ericameria laricifolia, Acacia angustissima, and Baccharis pteronioides. Agave palmeri and Dasyliron wheeleri are also frequently found in this community type, as are members of the cactus family such as Echinocereus triglochidiatus, and Opuntia phaeacantha.

Temperate Marshland

A Rush Community Type occurs only in the Silver Spur Meadow and is characterized by "wetland" species such as Juncus mexicanus, and Equisetum ferrissil. Other interesting species include cardinal flower Lobelia cardinalis, and centaury Centaurium calycosum. Grass species known within the monument only from the Silver Spur meadow are Bromus carinatus, Muhlenbergia asperifolia, and Sphenopholis obtusata (Reeves, 1976).

In 1975, a new genus and species of plant, Apacheria chiricahuensis, C. T. Mason, was discovered in the monument. Two other species, Perityle cochisensis, and Astragalus cobrensis, are endemic to the Chiricahua Mountains and are common in the monument. One species of orchid, Hexalectris warnockii, has been found in the State of Arizona on one occasion, that being in Chiricahua National Monument (1964).

Research Natural Areas

Thirty-six research natural areas have been created in Arizona and five of these are located in Chiricahua National Monument. Research Natural Area is a classification used by Federal land management agencies to designate lands on which various natural features are preserved in an undisturbed state solely for research and educational purposes. Natural processes are allowed to dominate in Research Natural Areas and natural features, vegetation in the case of Chiricahua, are preserved for the following:

1. To provide baseline areas against which the effects of human activities in similar environments can be measured.

2. To provide sites for study of natural processes.

3. To provide gene pool preserves for plant and animal species, particularly of rare and endangered types.

Five Research Natural Areas have been designated in the monument as follows:

ESTABLISHED RESEARCH NATURAL AREAS IN CHIRICAHUA NATIONAL MONUMENT

Natural Area	Acreage	Primary Interest
South Shake Spring	25	Interior Douglas Fir
East Picket Park	50	Pinyon-Juniper
Picket Park	40	Interior Ponderosa Pine
Far West Picket Park	90	Arizona Cypress
Jesse James	45	Interior Live Oak

All of these areas are now included in the 9,440 acres of designated wilderness found at Chiricahua. Dr. W. H. Moir examined the five natural areas in 1972 and found that while the areas did not represent all vegetation types found in the monument they did represent typical vegetation types found over much of the monument (Moir, 1974).

Visitors have had little impact on vegetation except in a few heavy use areas. However, the management policy of fire exclusion has adversely impacted vegetation. Roseberry and Dole composed an accurate vegetation type map in 1937. Prior to that time, natural fires were not effectively controlled in the monument; therefore, distribution, content and condition of vegetation types as described by Roseberry and Dole should accurately represent the condition of vegetation systems before fire exclusion became management policy.

During the last few years, the Roseberry and Dole map has been compared to vegetation systems as they presently exist. The results of this comparison indicate that the basic distribution, structure, and content of vegetation types has changed little in the last forty years. However, several plant species which are fire dependent are not reproducing, fuel accumulations are increasing, and many plant species which serve as browse for wildlife are overmature and in a state of degeneration. Adverse effects of fire exclusion will continue until fire returns to the monument's ecosystems.

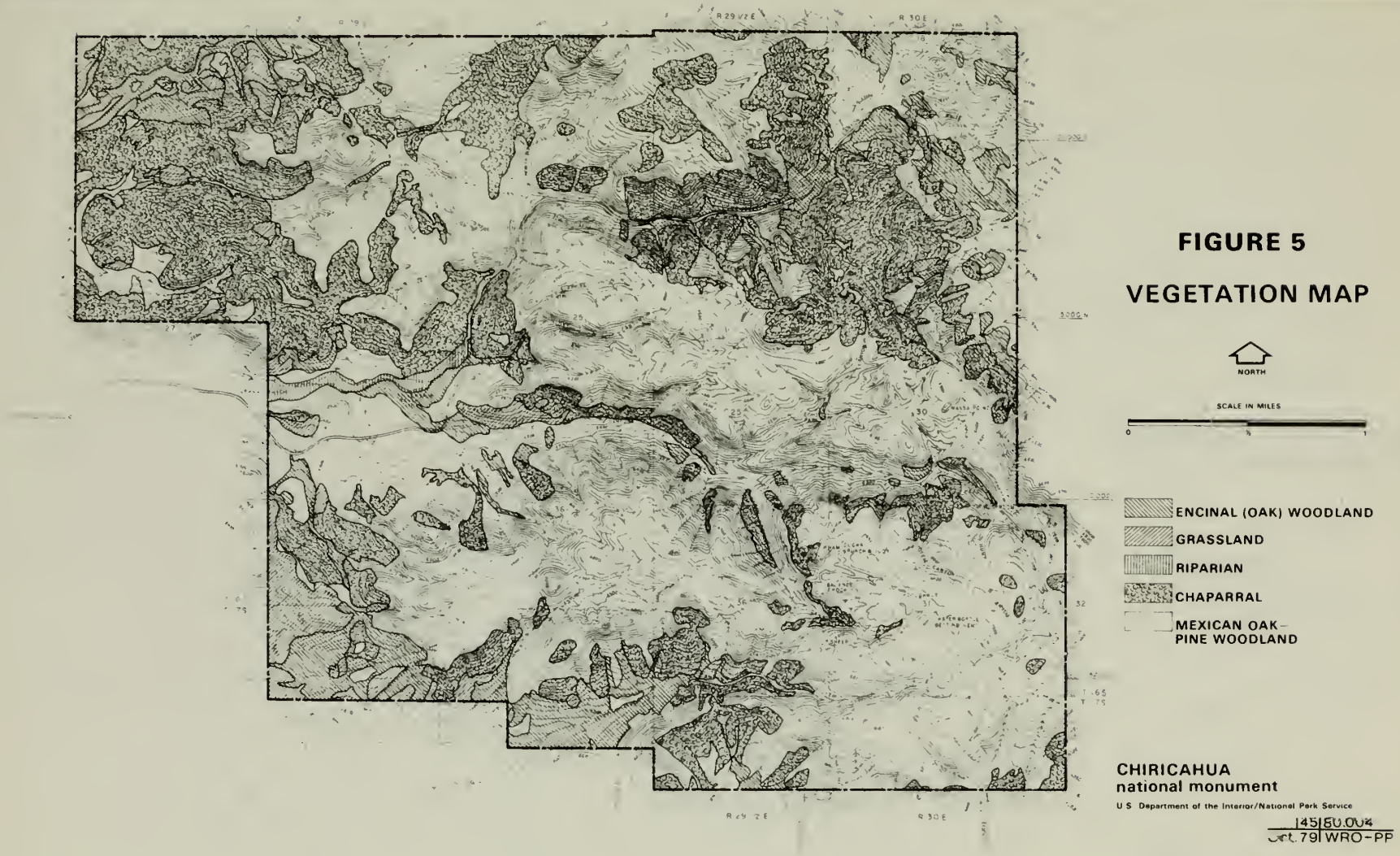

FIGURE 5

VEGETATION MAP

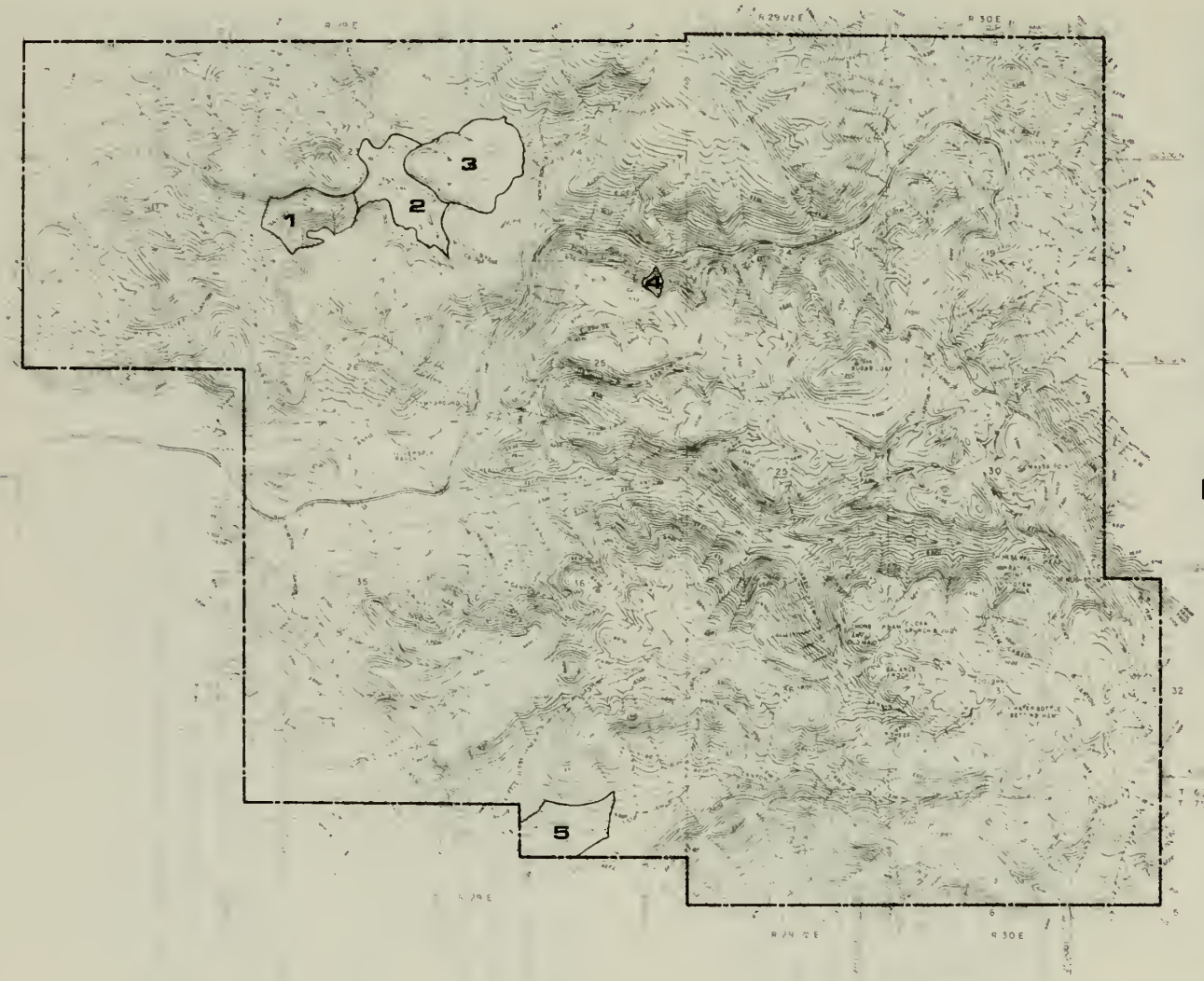

FIGURE 6

RESEARCH NATURAL AREAS

CHIRICAHUA NATIONAL MONUMENT/ARIZONA

1 Far Picket Park, West
2 Picket Park
3 East Picket Park
4 South Shake Spring
5 Jesse James

NORTH

0 ¼ ½ ¾ 1 Miles

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SOILS

Most of the monument's soils, with the exception of those in the southwest and northeast corners, are derived from rhyolite.

Mesas

Soils of the mesa tops are coarse and shallow with Rhyolite caprock very near to or on the surface. Runoff is excessive and the scouring effects of wind and rain restricts soil accumulation to very localized areas around vegetation bases and pockets in rock.

Canyon Sideslopes

Upper slopes are usually very steep and the soils in these areas are rocky and poorly developed, with excessive drainage. Midslope soils range from shallow to moderate depths, are well drained and poorly developed. Lower slopes, frequently have deeper colluvial soils on moderate grades. In some areas, the lower slope soils are mixtures of sediments deposited by both stream and downslope movement. Elsewhere, localized basin fill, as in Pickett Park, or fans, such as the Southwest corner are of Quaternary alluvium (Gile and Hawley, 1966). Other localized parent materials of Canyon sideslopes include talus or rock land. Climatic gradients of the canyons of Chiricahua are enhanced by complex drainage and soil patterns of sideslopes to produce a variety of vegetation types (Moir, 1974).

Canyon Bottoms

Canyon bottoms generally have deep, stable, alluvial soils and provide the most mesic habitats in the monument. While the stream channels are seasonally scoured by runoff from summer storms, the adjacent, relatively level, terraces are usually covered with heavy deposits of litter. They support stands of oak, pine, and Arizona cypress.

HYDROLOGY

Permanent streams or lakes do not occur in the monument and water availability depends on the amount of precipitation that falls on the watersheds and ability of soils and rock to store and transmit water. Within the monument, volcanic rocks are able to yield stored water in only limited quantities because their joints and fractures either are not

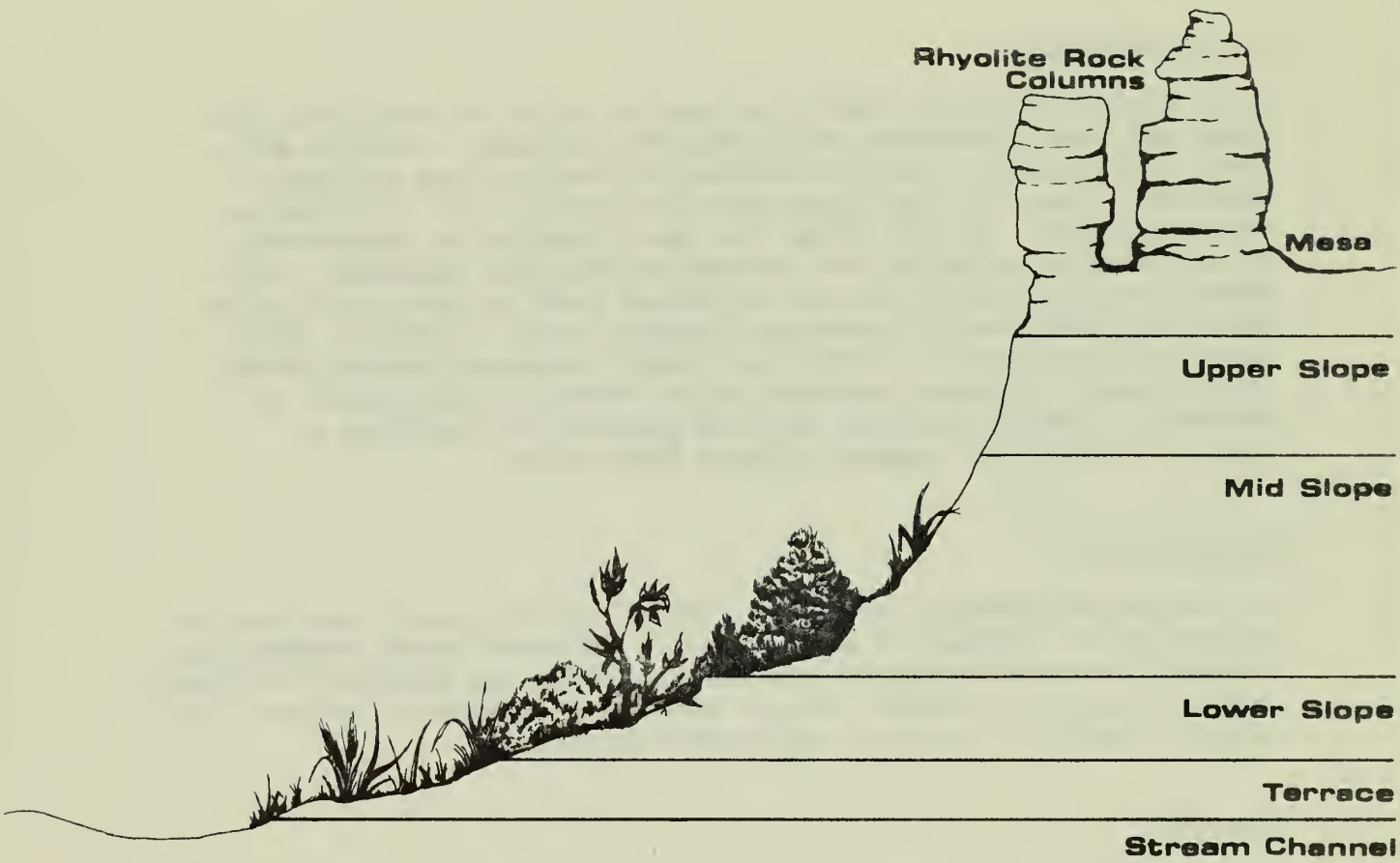

Figure 7. Generalized canyon topography in Chiricahua National Monument.

interconnected or have a small total capacity. Alluvial soils are more permeable than the volcanic rocks, and can store and deliver greater amounts of water (Johnson, 1959).

Surface flows in Rhyolite and Bonita Creeks occur during the summer rainy season, but their flow patterns are markedly different. Although both drainage systems receive approximately equal amounts of precipitation, Rhyolite Creek may flow continuously for several months after the summer rains begin, while Bonita Creek has short intermittent periods of flow. The variation in runoff patterns between the two probably relates to differences in vegetation cover and degrees of fracturing in rock beneath their drainages.

There are several springs within the monument. Shake spring, Bonita spring, and Bridger spring are all located in Bonita Canyon. Bridger spring is now inactive but Shake and Bonita springs have never been known to be dry and presently serve as a dependable water supply for the area's wildlife populations.

Two wells provide the domestic water supply for the monument. Both wells are located in Bonita Canyon near the campground. While they fluctuate in response to seasonal drought they have provided adequate water for monument demands. Hydrological information is limited for the monument and proposed research actions have been designed to correct this situation. Water monitoring schedules have been established and water quality is measured regularly in accordance with Public Law 92-500, 86 Statute 816.

AIR

Clean air, clear skies, and ability to see prominent landscape features for long distances, 75-100 miles dpending on location of viewer, have made Arizona famous in many parts of the world. Arizona's excellent air quality conditions were characterized by low particulate matter, low humidity, and extreme clarity. However, as Arizona's population increased air quality decreased and air pollution became a major problem in much of the state.

Air is an essential natural resource component which influences all other natural resources and is, therefore, of great importance in all natural resource management considerations. Air pollution has increased in the Chiricahua area but the extent of increase or effects of air pollution on the monument's flora and fauna are unknown. Research is proposed to acquire appropriate information concerning air quality.

WILDLIFE

Chiricahua supports a variety of wildlife and information exists on the more prominent species, especially large mammals, such as deer. However, information concerning smaller, less conspicuous species of wildlife is absent. Extensive studies of the monument's vegetation and geology have been conducted but ecological studies related to wildlife populations have generally been limited to a few species.

Mammals of Chiricahua include mountain lion, mule deer, whitetail deer, fox, coati, peccary, and black bear. Due to isolation of mountain habitats, some forms of wildlife, such as Apache fox squirrel, have become locally distinct. The coati and Apache fox squirrel are at their northern limit of distribution in the Chiricahua Mountains. The jaguar (Endangered) was last sighted in the monument in the early 1900's and the grey wolf (Endangered), has been sighted in the monument several times in the last six years.

Over 100 species of birds have been recorded in the monument, and nesting sites for hawks, falcons, golden eagles, and owls are present in many vertical cliff sections in the area. Birds of particular interest, because of their peripheral or threatened status, include the zone tailed hawk, northern violet crowned hummingbird, western blue throated hummingbird, coppery tailed trogon, peregrine falcon (Endangered), and great blue heron.

Reptiles and amphibians are common in the monument and over sixty species have been recorded on checklists. Amphibians include the Western spadefoot toad (Scaphiopus hammond), Great Plains toad (Bufo cognatus), and canyon treefrog (Hyla arenicolor). Reptiles are well represented, and include alligator lizards, skinks, and thirty two species of snakes. Three species of rattlesnake, banded rock, twin spot, and Arizona ridgenose, are endemic to the mountains of Southeastern Arizona.

Few invertebrate species have been listed to occur in the monument largely due to the absence of research. A small insect collection has been made, but information on these and other invertebrates is limited.

Continued hunting and trapping of predators in the adjacent Coronado National Forest plus extensive predator removal on neighboring ranchlands has altered predator-prey relationships in the monument and will complicate the reestablishment of natural balances. In addition, fire exclusion has been responsible for reductions in plant diversity and consequently a reduction in animal diversity.

LAND CLASSIFICATION

For management purposes, the monument's land has been divided into four zones, one of which has been further divided into three sub-zones. The classifications have been selected primarily by considering such factors as significant resources, present uses, and legal and legislative constraints.

Development Zone

This is a single zone of 100 acres whose dominant use is the provision of facilities and services for visitor use and enjoyment of the area. Facilities include, but are not limited to a visitor center, a campground, monument offices, support facilities, employee housing, and vehicle parking. The zone is managed to provide necessary services while limiting their impact on the natural scene.

Natural Zone

Natural Environment Sub-Zone

Two parcels comprising 420 acres have been classified in the "Natural Environment" sub-zone. They are essentially buffer zones separating designated wilderness areas from developed areas. These lands are managed to maintain their primitive character.

Wilderness Sub-Zone

This sub-zone covers two major areas that were designated by Congress (PL 94-567, 10-26-76) as wilderness totalling 9440 acres which are managed primarily to perpetuate natural and primitive land characteristics. Within this designation development and "improvements" are limited to the absolute minimum required for administration of the area. There are no roads and no structures, with the single exception of the fire lookout on Sugarloaf Mountain. Motorized equipment and aircraft are not to be used in this sub-zone except in emergencies involving health and safety of persons in the area.

Outstanding Natural Features Sub-Zone

An area totalling 3020 acres comprises the Outstanding Natural Features Sub-Zone. This sub-zone contains outstanding geological features, the

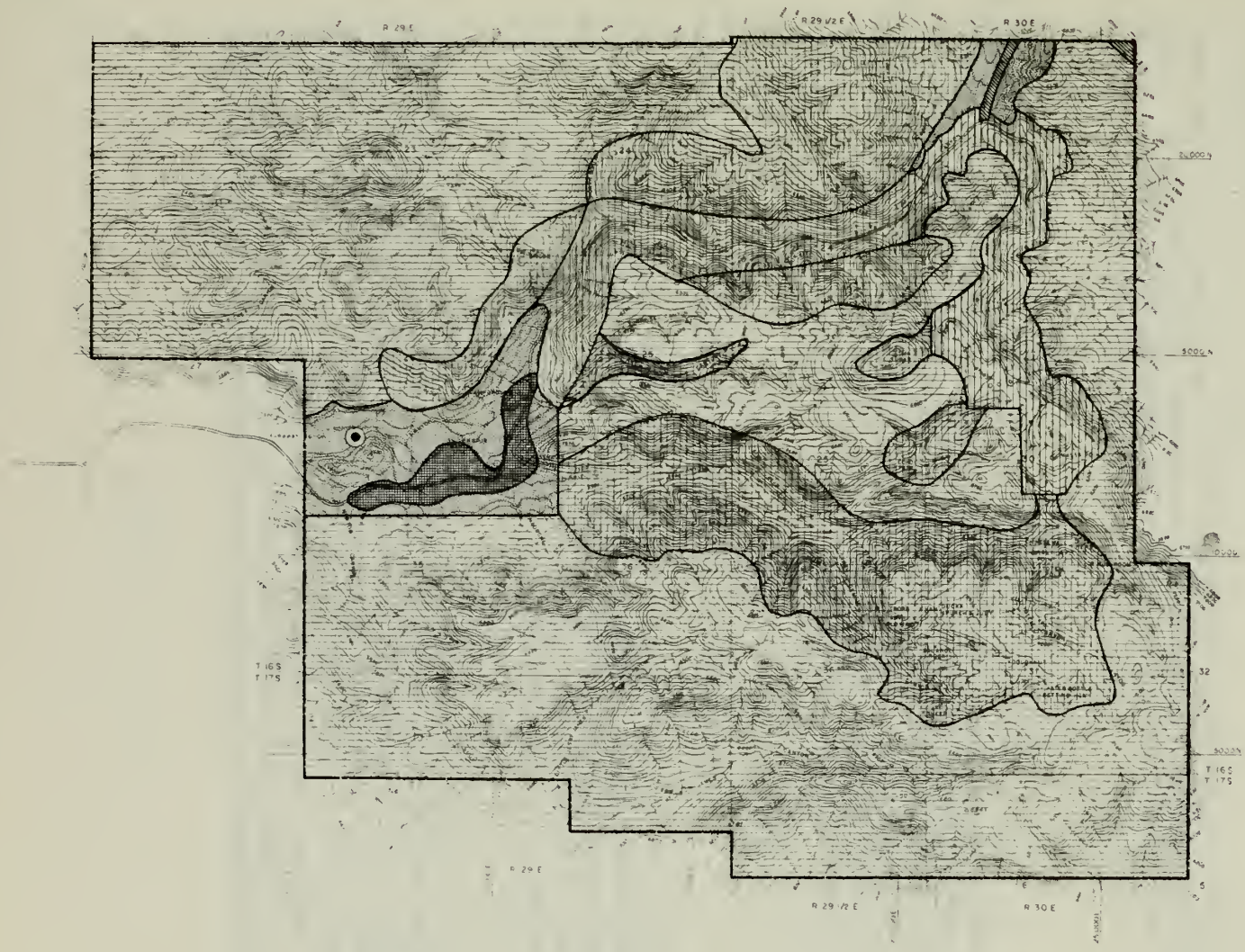

FIGURE 8

LAND CLASSIFICATION

CHIRICAHUA NATIONAL MONUMENT
ARIZONA

NATURAL ZONE
- Natural Environment Subzone
- Wilderness Subzone
- Outstanding Netural Feature Subzone

DEVELOPMENT ZONE

HISTORIC ZONE

SPECIAL USE ZONE

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primary monument road, and parking area and interpretive shelter at Massai Point. 2,270 acres of this area are located within designated wilderness and therefore share concurrent land classification with the wilderness sub-zone. This sub-zone is managed (1) to protect and preserve the area's natural and scenic resources and (2) to provide minimal facilities necessary for public use and enjoyment of those resources. Therefore, all facilities are designed and constructed so as to minimize their impact on the surrounding natural features.

Historic Zone

This zone of 3.5 acres contains the Stafford Cabin National Register Site. It is managed for preservation, protection, and interpretation of this property and subordinates all other uses to preservation of this significant historic resource.

Special Use

The "Special Use" zone is the monument's only remaining inholding. The inholding, 2.35 acres, and the corridor of an administrative road whose primary function is to provide access to the inholding are located in the northeast corner of the monument. Management of the road is directed toward minimum maintenance as required to serve its present purpose. The inholding has been designated as potential wilderness.

ARCHAEOLOGY, ETHNOGRAPHY, HISTORY, AND PALEONTOLOGY

Cultures of the past, whether they were foragers who gathered wild plant food and hunted animals, or agricultural peoples, who depended upon water and arable land, used the Chiricahua Mountains and surrounding valleys for at least 10,000 years. Therefore, the primary archaeological significance of the monument lies in its potential fund of information relating to limited or seasonal use by past cultures.

The Cochise culture (8000 B.C.-100 A.D.) existed in valleys to the east and west of the monument. This culture represents the earliest evidence of man in this area and has been divided into four stages: Sulphur Springs (8000-5000 B.C.), Cazadore (5000-4000 B.C.), Chiricahua (4000-2056 B.C.), and San Pedro (1350 B.C.-100 A.D.). The lifeway of the Cochise culture was primarily one of gathering and hunting. Since subsistence depended upon the gathering of wild plants and hunting, the people of this culture probably moved continuously throughout several

ecological zones and did not establish permanent villages. However, during the San Pedro stage, indications are that a transition from gathering and hunting to agriculture occurred. The San Pedro stage seems to be the final phase of the Cochise culture. Apparently during this period wandering hunters and gatherers of earlier stages were gradually replaced by people who engaged in rudimentary forms of farming and settled in more nearly permanent villages.

The Mogollon culture (300 B.C.-1200 A.D.) may have evolved directly from the Cochise culture of the San Pedro stage by a process of slow, continuous development. While cultural differences between the two may have been slight from one generation to the next, the Mogollon culture eventually became a fully developed, pit-house village, agricultural system (Quinn and Roney, 1973). Grasslands and outwashes were the most frequently farmed types of land during the Mogollon period and areas in the monument which provided water and arable land could have been used by these people. As an example, lower Bonita Canyon has deep soils and permanent springs and would have been an ideal location for village farmers of the Mogollon period.

The Salado culture (Southeastern Arizona 1200 A.D.-1400 A.D.) marks a significant change in village organization and house construction among agricultural peoples of southern Arizona. The Salado constructed large surface pueblos, such as Casa Grande, rather than pit houses or individual surface dwellings. This change in village construction reflected an increase in the intensity of agricultural activity. Most researchers agree that the Salado culture was a combination of Hohokam, Anasazi, and Mogollon (McGregor, 1965).

Polychrome pottery is the primary distinguishing characteristic of the Salado (Steen, 1962) and a large village site containing this type of pottery was excavated in the San Simon valley from 1940-1949. The village consisted of a group of small surface pueblos which exhibited many of the Salado building characteristics. In addition, sites were found in the Portal, Arizona area, south of the monument, which appear to have been occupied by the Salado between 1200 and 1400 A.D.

The ultimate fate of agricultural peoples who inhabited this area is unknown, however, evidence indicates that southeastern Arizona was largely abandoned by 1400 A.D. The reason for abandonment could have been that the farming population reached such proportions that water supplies were no longer sufficient to sustain the extensive agricultural system.

The most recent native inhabitants of the area were the Apache, who arrived around 1500 A.D. There is no evidence that the Apache secured

the area by force and this supports evidence that the area was abandoned prior to their arrival.

Hunting and gathering were the primary lifeways of the Apache but they also practiced limited agriculture. Like the earlier Cochise people, they foraged in the monument area. Also, the Apache participated in occasional raids on neighboring non-Apache Indian groups and eventually on Mexicans and Anglo ranchers and by the nineteenth century raiding was of considerable economic importance in Apache culture.

The Apache population consisted of scattered bands dispersed through the countryside (Opler, 1941). Seasonal migrations were required by gathering and raiding activities; therefore, camps were temporary. Because of their transiency, the Apache have left a scanty archaeological record. Apache sites in the area are recognized primarily by presence of metal projectile points, glass beads, mescal pits, and wickiup depressions (Quinn and Roney, 1973).

The earliest documented ventures by Europeans into the Chiricahua area were those of Spanish expeditions. The Spanish eventually organized military expeditions, in retaliation for Apache raids on Spanish settlements, against the Apache in the mid-eighteenth century. These expeditions were continued by Mexican troops until the United States acquired the area through the Gadsden Purchase of 1854. Apaches were friendly to Americans at first and allowed trappers in the area in the 1820's. The first survey of the area was conducted by John R. Bartlett in 1851, and another survey team, led by Lt. J. G. Parke, visited the area in 1854 and camped in what is now the Fort Bowie National Historic Site. Apache relations with the Americans deteriorated after 1854 and finally led to warfare in 1861.

In 1878, the Apache Wars were almost over and only scattered bands of guerillas such as Geronimo's group were offering resistance. Several ranches were being established in the area and silver was discovered on the southeastern slopes of the Chiricahua Mountains creating the boom-town of Galeyville.

The Riggs family established a ranch five miles west of lower Bonita Canyon in 1879 and in spring of the same year Lewis Prue constructed a block house near the mouth of Bonita Canyon. In 1880, Colonel J. Hughes Stafford built a cabin above the Prue house and raised truck garden produce which he irrigated with warm water from thermal springs. Stafford sold the produce to Fort Bowie on a regular basis until the earthquake of 1887 when the thermal springs became cold. In 1881, Neil Erickson,

a Swedish immigrant and member of the fourth cavalry at Fort Bowie was temporarily stationed at an Army camp in Bonita Canyon. Erickson left the Army in 1886 and in 1888 established the Faraway Ranch, one-quarter mile below the Stafford cabin. Faraway Ranch house was started by Erickson in 1888 and represents one of the two structures of this type to be built in southeastern Arizona in the 1880's.

Cattle ranching became the mainstay of the local economy in the late nineteenth century and initiated severe environmental deterioration in many areas. The San Simon Cattle Campany allowed as many as 80,000 cattle to graze in the San Simon Valley for several years. Cattle in numbers such as these severely altered vegetation systems and the extensive grasslands, characteristic of the valley, were diminished to be replaced by desert shrubs and plants indicative of poor soils and declining natural resource conditions. A five-year drought in the 1890's plus declining cattle prices brought an end to the San Simon Cattle Company but vegetation of San Simon Valley has not recovered significantly in the years which have followed.

Fifteen buildings and structures in Chiricahua, dating from the Civilian Conservation Corps era, are on the List of Classified Structures. They have potential National Register significance due to their CCC associations and their rustic architecture. Built mostly of native stone, the buildings harmonize well with their environment and as a group excellently represent one of many particular styles of rustic design.

The Echo Canyon Trail is also on the List of Classified Structures as a result of its CCC associations and potential significance in landscape architecture.

A study of the historic background of the monument for interpretation, management or planning, and a historic resources study will be programmed in preparation of National Register nominations on the listed structures as well as any other structures or sites identified in the study. Acquisition of Faraway Ranch was proposed in 1978, and Congress has recently passed legislation adding it to the monument. A required historic structures report including historical and architectural data sections, will be programmed soon for this acquisition.

Paleontological resources are limited. Paleozoic brachiopods in limestone deposits located in the northeast corner of the monument represent the only known fossils in Chiricahua National Monument.

VISITOR USE AND FACILITIES

Approximately 60,000 people visit Chiricahua each year. Upon entering the monument, visitors are required to stop at the Visitor Center and pay a daily-use fee, and camping fee if applicable. Generally, visitors spend fifteen minutes to one-half hour viewing exhibits and a slide orientation program. Ninety-three percent of Chiricahua's visitors view the monument from the seven-mile paved road that begins at the Visitor Center (Elevation 5400') and ends at Massai Point (Elevation 6800'). At Massai Point, about eighty percent of the visitors tour the geological exhibit building and walk the five hundred yard self-guiding nature trail. In contrast, less than thirty percent walk the Forest Foothills nature trail located at the Visitor Center.

Seven percent of Chiricahua's visitors hike through the monument on the seventeen mile trail system. In addition to the one-half mile nature trails, twelve miles of improved trails lead through Heart of Rocks, Echo Canyon, Sara Deming Canyon, and Rhyolite Canyon. These trails begin at Massai Point and terminate at the Visitor Center. The Natural Bridge trail (2.5 miles) begins three miles north of the Visitor Center and penetrates the Picket Park Natural Area. Sugarloaf trail (1 mile) begins one-half mile north of Massai Point and ascends Sugarloaf Mountain (Elevation 7300'). A one-half mile trail begins at the campground and leads to the Silver Spur meadow and the Visitor Center. The regenerative capacity of the backcountry through which these trails pass is good and present use levels can be sustained.

Approximately 11,000 visitors per-year remain overnight in the 37 site Bonita Canyon campground located two miles north of the Visitor Center. Backcountry camping is not allowed. The campground has indoor restrooms and water is available. The camping area is the most heavily used and impacted unit in the monument and management action will be taken to reduce or eliminate further deterioration.

REGIONAL INFLUENCES

The Heritage Conservation and Recreation Service states that their records show a total of 2.2 million acres of recreation lands, administered by Federal, State, and local agencies, occur within 100 miles of the monument. Most immediate of these areas to the monument is Coronado National Forest. Ten miles south of the monument visitor center is the 18,000-acre Chiricahua Wilderness which encompasses the crest of the Chiricahua Mountains. Since most of the acreage of this wilderness area is in the Transition, Hudsonian, and Canadian life zones, it complements the oak-pine woodland of the monument and provides

area visitors with an opportunity to visit a variety of mountain habitats. The Forest Service maintains a graded road across the Chiricahua Mountains through Pinery Canyon and a dirt road used for grazing management also traverses the Forest Service area to the north of Picket Park. Remains of an old dirt road traverse Hands Pass to the east of the monument and serves as a four-wheel drive road for visitors. Rustler's Park and Barfoot Park camping areas, located south of the monument, are especially popular during the summer but are generally snow closed during the winter months.

A major research facility of the American Museum of Natural History, The Southwestern Research Station, is located east of the monument in Cave Creek Canyon near Portal, Arizona. The station hosts numerous scientists conducting field studies in the surrounding area from March through November and has been of valuable assistance to the monument in providing information concerning the area's flora and fauna.

Cochise County is one of the more rural counties in Arizona. Major population centers are small towns such as Bisbee (8,000), Douglas (12,000), Willcox (3,000) and Sierra Vista (15,000). The entire county is highly dependent upon agriculture, mining, and tourism. Grains dominate agriculture production but cotton, alfalfa, and vegetables are also produced. Approximately two-thirds of the agricultural income is from crops and one-third from livestock which graze extensive areas of private and public lands.

Military expenditures, due largely to the presence of Fort Huachuca in southwestern Cochise County, comprises sixty-one percent of government spending in the county. The base has a daytime population of more than fourteen thousand. More than twelve million dollars for construction have been spent on the Fort Huachuca Military Reservation in the last few years.

Thick alluvial soils in the Sulphur Springs Valley, west of the monument, store large amounts of ground water. Recharge of ground water results from stream flow seepage into coarse material along mountain fronts, direct infiltration of rain water, and infiltration of excess irrigation water. The Chiricahua Mountains contribute significantly to this recharge of ground water. A noticeable water level decline, as much as thirty-feet over a three month period, is occurring in the Willcox, and San Simon basins. One apparent result of rapid water table decline has been the appearance of earth fissures and sections of sinking land in the Willcox and San Simon basins. These phenomena will probably continue as the water table declines and could affect farming, highway, railroad, and utility operations.

In a 1972 survey, conducted by a regional planning project in southeastern Arizona, manufacturing, industry, tourism, and local business development were considered of greatest economic potential in Cochise County. With reference to natural resources, the survey stated that land availability and ground water were of greatest concern as limiting factors in future development.

Arizona and California are the sources of more than one-half of the monument's visitation. Since both of these states are experiencing large population growth, the monument can expect increasing visitor use. Fuel shortages and/or higher fuel prices may counteract this effect but there is a possibility that the monument's facilities and services may be used to capacity in the near future. In addition, nearby landowners have been developing large scale residential subdivisions within 12 to 30 miles of the monument. The long term affect that these population centers will have on the monument is unknown but some increase in day use can be expected.

PROBABLE FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

Regardless of whether the Natural Resources Management Plan is adopted and translated into an action program the future environment of Chiricahua will not remain as it is today. Environmental change will occur and the purpose of this plan is not to prevent natural environmental changes or create a management program which attempts the impossible task of preserving the area's natural resources in a static condition. However, it is the purpose of this plan to minimize or eliminate adverse environmental impacts associated with heavy visitor use and improper management of the monument's natural resources and insure that wherever possible all natural processes will be allowed to exert their influences without alteration or impedance by man. Failure to implement all or part of the proposal will preclude responsible or effective management of the area's natural resources.

If fire is not returned to the monument's ecosystems, fuel accumulations will continue to increase and eventually create conditions favorable for the occurrence of holocaustic fires. In addition, vegetation and wildlife populations will be progressively altered as the effects of fire exclusion become more pronounced.

Failure to fence the monument's boundaries in such a manner that will prohibit future grazing of the monument by domestic livestock will result in damage to vegetation systems when grazing does occur. Also,

native wildlife will be forced to compete with domestic animals for forage and water. If heavy use areas are not rehabilitated and visitor use patterns redirected in such a manner that will reduce adverse impacts, then these areas will expand and continue to deteriorate to the point where corrective management will be difficult or impossible.

Research actions are proposed to provide the information necessary to make accurate management decisions concerning natural resources and accumulate a data base which can be used by the monument staff now and in the future. Failure to carry out proposed research actions will assure that future natural resource management decisions will be made in the absence of an accurate information base.

ENVIRONMENTAL IMPACTS OF PROPOSED ACTIONS

The natural resources management plan for Chiricahua National Monument will have impacts upon the environment and upon those people who enjoy and utilize the natural resources within the monument. The plan provides for the management of natural resources and visitor activities in a manner that will not allow man's influences upon the monument to proceed in the absence of regulation. It will result in research and management directed to minimize disruption to ecosystems and to assure natural processes will occur in the future.

Environmental impacts associated with proposed management actions are of two basic categories, those which will reverse or repair environmental damage caused by heavy levels of use and those which will correct improper management decisions and policies of the past. Specific impacts include the following:

CHIR-RM-1 Natural Resource Monitoring System

The Natural Resource Monitoring System was installed in 1974 and has provided valuable information concerning the monument's vegetation and soil resources. The system will continue to provide quantitative data concerning natural resource conditions and will give park management the capability of monitoring changes in vegetation and soil surface characteristics in different management zones. Areas of high visitor or maintenance impacts will be identified by the system before serious resource damage occurs. The overall impacts of the monitoring system will be to offer an alternative to inaccurate visual methods of resource evaluation utilized in the past and to provide an early warning system for natural resource deterioration.

CHIR-RM-2 Fencing of Boundaries

Grazing of domestic livestock in the monument is not provided for by law and is not compatible with the purposes for which the monument was created. Fencing of boundaries with barbed wire will eliminate trepass grazing and allow vegetation, soils, and wildlife to recover from the impacts of cattle grazing. Removal of grazing animals will allow grasses, shrubs, and other plants to complete their annual growth cycles without being continually browsed or grazed by domestic animals. Soil erosion will decrease as vegetation begins to increase and cover more soil surface area. Cattle trails and bedding sites will gradually disappear as plant cover increases. In addition, native animal species which utilize vegetation for food will no longer have to compete

with livestock for food or water. Fencing will also delineate the legal boundaries of the monument, reduce accidental entry of hunters, and assist law enforcement efforts to eliminate poaching.

The fence construction process will cause some disruption of soils and minor destruction of vegetation. In addition, the visual intrusion of a straight line barbed wire fence will detract from natural surroundings.

CHIR-RM-3 Construction of Trails

Construction of trails in the vicinity of the campground will assist in eliminating damage to vegetation resulting from the numerous pathways created by random cross-country hiking. A trail around the Bonita Canyon Campground will provide and direct public access to points of interest in the area and provide much safer hiking conditions than presently exist. Interpretive devices along the trail will inform the public and discourage wood gathering, ground fires, plant removal, and molesting of wildlife. The primary impacts of the trails will be to redirect public use patterns, and reduce adverse environmental impacts.

Dust and noise of machinery will be generated in the process of trail construction. Also, soils and vegetation in the path of the trail construction will be altered or destroyed.

CHIR-RM-4 Closure and Rehabilitation of Heavy Use Areas

Closure and rehabilitation of abandoned roads and other heavily impacted sites will provide for the return of more nearly natural conditions and help to erase adverse environmental impacts resulting from misuse. Closure of campground sites on an alternating basis will allow vegetation and soils a recovery period. Additional management actions such as reducing soil compaction, mulching, seeding, and irrigating will accelerate the recovery process and enable trees, shrubs, and other flora to withstand continued use and retain their resiliency. The overall impacts of this action will be to reverse natural resource deterioration in heavy use areas and remove the scars of detrimental human activity. The aesthetic qualities of heavy use areas will be improved as the management action progresses.

Closure of heavy use areas will temporarily or permanently exclude them from continued public use. Rehabilitation work will disturb soils,

create dust and machine related noise and offer visual intrusion where barriers are used to close sites.

CHIR-RM-5 Site Management With Native Plant Species

The use of native plants to revegetate barren, heavy use areas will assist in the rehabilitation of those areas and preclude the chance of contamination of the monument's flora by exotic species. A more nearly natural environment will be created in heavily impacted areas as native vegetation begins to grow and reproduce.

CHIR-RM-6 Management of Endangered and Threatened Species

This management action will have the impact of creating a management program which will provide for the protection and perpetuation of endangered and threatened species of plants and animals found in the monument. In addition, those species which deserve "special" management attention, such as endemics, will be identified and managed as if they were endangered.

CHIR-RM-7 Fire Management

Returning fire to the monument's ecosystems will have greater impacts on the area's natural resources than any or all of the other proposed management actions combined. A considerable amount of data concerning the effects of fire on vegetation types and wildlife which occur in the monument have been collected from studies conducted in Arizona and California. These data indicate that, in general, periodic natural fires are necessary to reduce fuels, prevent dangerous accumulations of fuel, stimulate the reproduction and improve the quality of many plant species, and increase the rate of nutrient cycling of forest ecosystems. Impacts of returning fire to Chiricahua will be that components of the monument's ecosystems will change and return to more nearly natural conditions.

Fire will result in the temporary reduction of air quality as smoke is produced. Some vegetation and wildlife will be destroyed and/or injured. Burned areas will be temporarily blackened and there is a danger that combustible cultural artifacts could be consumed by natural or prescribed fires. Soil erosion and water runoff rates will increase on watershed slopes where fire has removed litter, duff, and understory plants.

Proposed research actions are designed to cause the accumulation of a data base concerning the monument's natural resources. The impact of research actions will be the creation of a data base suitable for use in resource management decision making. Failure to implement proposed research actions will severely limit the success of several management actions and deny monument staff of essential information.

MITIGATING MEASURES INCLUDED IN PROPOSED ACTIONS

The Natural Resources Monitoring System was designed to detect adverse impacts to the monument's vegetation and soils so that corrective measures can be taken to reduce or eliminate those adverse effects which occur. The permanently marked transects which make up the system will continue to be installed in a manner that will prevent visual intrusion or detection by the monument's visitors.

A minimum of clearing will be conducted during the construction of boundary fencing. Sufficient clearances will be provided so that wildlife movement will not be hindered. The elimination and prevention of grazing by domestic livestock will have a greater beneficial impact to the monument's natural resources than any adverse impacts generated in the fence construction process.

The periphery trail around the Bonita Canyon Campground will follow pathways which already exist, therefore, additional clearing of vegetation or disturbance of soil will be held to a minimum. Consideration will be given to the area's natural resources during the planning of the trail and impacts will be confined to a manageable, maintainable corridor.

Campground sites will be closed on an alternating basis and no more than six campground sites will be closed at any one time. Machinery necessary to prepare seedbeds will be operated only during those times when campground use is at a minimum. Temporary or permanent visitor barriers around seedbeds will not prevent or unduly delay travel in the campground area. All fences and/or barriers will be clearly marked and erected with visitor safety in mind.

Only plants native to Chiricahua will be used for rehabilitation of heavy-use areas. Preliminary study will assure that the best techniques are followed and the correct choice of species made for reestablishing plants in barren or heavy impact areas.

Every effort will be made to assure that endangered species and those species recognized as deserving special management attention will not be adversely affected by any phase of the monument's management program.

The fire management program will be initiated only after appropriate research and notification of necessary authorities, including the State Air Quality Control Board, has been conducted. Natural fires will be closely monitored and appropriate suppression action provided if the

need arises. All prescribed fires will be restricted to small manageable sizes and located, whenever possible, in such a manner that will reduce visual impacts. Local landowners, U.S. Forest Service, Bureau of Land Management, and appropriate State agencies will be notified prior to all prescribed fires and during natural fires.

In compliance with the National Historic Preservation Act of 1966 and Executive Order 11593, all archeological sites uncovered as a result of natural or prescribed fires will be inventoried. Archaeological surveys will be made before any ground disturbing activities such as boundary fencing trail construction, or prescribed fires are undertaken.

ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

The implementation of the Natural Resources Management Plan for Chiricahua National Monument will bring about some unavoidable adverse effects. However, these effects will be reduced through mitigating measures or eliminated as the management actions progress toward planned objectives.

Those adverse effects expected to occur include the following:

Fencing the monument's boundaries will have adverse impacts on the vegetation which will be removed and/or crushed in the fence building process. The visual impacts associated with a straight line barbed wire fence cannot be avoided and some soil erosion will occur as a result of travel into and out of fence construction sites.

Trail construction around the campground and to other points of interest will create dust and noise during some construction periods. Small amounts of vegetation will be disturbed or destroyed in the building process. Some erosion will occur in those areas where grades and slopes are altered to accomodate trail surfaces.

Closure and rehabilitation of campground sites and heavy use areas will not permit full recreational use by visitors. Methods used to reduce soil compaction will result in short-term disturbance of soils and some erosion.

Site management with native plant species will cause minor disturbance of soil and vegetation for a short period of time in localized areas. Planting of native seeds by man will preclude the occurrence of natural patterns of plant succession.

Fire management actions will provide for the return of natural fires and allow prescribed fires under specified conditions. The return of fire to the monument's ecosystems will ultimately be beneficial to the area's natural resources. However, there will be some short-term adverse effects which will include temporary blackening of the landscape, changes in air quality, and destruction of vegetation. There is a remote possibility that combustible artifacts from previous cultures could be consumed during natural or prescribed fires. In addition, there is a possibility that fires could escape into the adjacent Coronado National Forest or onto privately owned lands.

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The primary considerations in the development of this document were the natural resources of Chiricahua National Monument. Adoption and implementation of the plan will prescribe management actions necessary for the perpetuation and protection of the natural resources of the monument. The plan will provide for long-term productivity of natural resources without prohibiting or greatly reducing continued recreational use by the public.

Natural or prescribed fires will have immediate short-term effects on the soil, animals, and plants in burned areas. In addition to blackened landscapes, soil pH and moisture relationships will be altered, diversity and numbers of plants and animals reduced, and the overall structure and function of various habitats changed. The visual aspects of these short-term effects will be temporary but other effects will be rather long lasting. The diversity and number of plant and animal species will gradually increase to levels higher than pre-fire conditions. The return of fire to the area's resources will eventually enhance the long-term productivity of those resources.

Closure of campground sites will cause short-term inconveniences to the public and remove small areas of the monument from recreational use. However, these inconveniences will be mitigated by a more pleasing camping area capable of sustaining use while maintaining its ability to recover.

Fencing of the monument's boundaries will eliminate the short-term benefits and economic gains associated with cattle grazing but will have the long-term effects of allowing grazed areas to recover and remain in a reproductively active and relatively unimpaired condition.

Greater control over visitor use patterns and intensities will deny some short-term benefits derived from uncontrolled recreational use. However, the long-term effects will allow the vegetation and soils of heavily impacted areas to recover and return to more nearly natural conditions.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTIONS SHOULD THEY BE IMPLEMENTED

Combustible artifacts could be lost in natural or prescribed fires and would thus represent an irretrievable commitment of those resources. No other irreversible or irretrievable commitments of natural resources will be involved in the implementation of the Natural Resources Management Plan for Chiricahua National Monument.

ALTERNATIVES TO PROPOSED ACTIONS

Resource Monitoring System

Alternatives considered for this action were to continue the visual monitoring system, employment of remote sensing techniques of resources monitoring, and use of alternative field methodologies. The visual evaluation of natural resources and their responses to both natural and man-caused impacts has to date provided an unacceptable method of assessing the condition and trend of the monument's resources.

Remote sensing techniques have become increasingly more useful, available and sensitive to changing natural resource conditions. However, satisfactory remote sensing data is expensive and involves the collection of ground truth information of the type provided by small plots or other field techniques. In addition, resolution scales of remote sensing are not appropriate for micro-site observation of vegetation or soils. Alternative field methodologies of resource monitoring such as examination of fossil sequences, study of landforms of differing ages, comparison of existing features with old records, and other varieties of sampling procedures could be adapted to the existing monitoring program whenever appropriate.

Boundary Fencing

Alternatives considered were to allow grazing to continue without additional fencing and to fence immediately. Trepass grazing is incompatible with the lawful purpose of the monument and is therefore not an acceptable alternative. Immediate fencing of the monument is desirable, however, the condition of the area's natural resources coupled with the fact that trepass grazing no longer occurs does not demonstrate a need to place a high priority on this alternative.

Bonita Canyon Periphery Trail and Closure and Rehabilitation of Heavy Use Areas

Alternatives considered were to allow the deterioration to progress, close the campground, fence the campground, and relocate the campground. No action would ultimately result in long-term damage to vegetation, soils, and wildlife which depend on the existing environment. Closure of the campground would be the most desirable alternative and

would permit total recovery of the area's natural resources. Fencing of the campground would restrict environmental damage to the immediate campground area but would not permit visitors to hike to points of interest near the campground.

Site Management With Native Plants

Alternatives considered were to allow deterioration of natural resources to continue, and to use exotic plant species. The no action alternative is not acceptable and is not in keeping with Service policies or management objectives. Easily managed exotic species such as Orchard grass, Smooth Brome, Lehmann's Love grass, and Farmington Side Oats Gramma, could be used to rehabilitate heavily impacted sites; however, the use of exotic plant species creates the risk of genetic contamination of native species or the introduction of an exotic plant which would replace a native species.

Endangered Species Management

In accordance with the Endangered Species Act of 1973, there are no alternatives. Management objectives of Chiricahua also do not provide for alternatives to the management of plant or animal species unless they provide for the protection, preservation and perpetuation of those species.

Fire Management

No action was the only alternative considered. This alternative is not acceptable since it would result in unacceptable adverse environmental impacts to the monument's ecosystems.

Research Actions

The only alternative to research actions were essentially no action alternatives. Failure to collect necessary data concerning natural resources to be managed precludes responsible management of those resources. Implementation of resource management programs without adequate data collection can lead to environmental damage and/or natural resource loss.

CONSULTATION AND COORDINATION

This plan was prepared by William B. Murray of Chiricahua National Monument with assistance from the staff of the Western Regional Office, National Park Service, in San Francisco and Chiricahua National Monument. Contributors were Lewis Albert, Michael Eames, Bill Lukens, Milton Kolipinski, and Andy Wigg of the National Park Service. Several outside sources were also consulted and include Dr. Will Moir of Rodeo, New Mexico, Dr. Donald F. Post of the University of Arizona, and Mr. Timothy Reeves of Arizona State University.

Informational copies of the plan and environmental assessment will be sent to the following organizations and their comments will be requested. All letters of comment will be reviewed by the Superintendent for implementation. Copies of the assessment and public comments will be available at the Monument and at the National Park Service, Western Regional Office in San Francisco, California.

Bureau of Land Management, Safford, AZ
Coronado National Forest, Tucson, AZ
Environmental Protection Agency
Manager, Western Archaeological Center, National Park Service, Tucson, AZ

Arizona Game and Fish Department
Arizona State Clearinghouse
Arizona State Historic Preservation Officer
Department of Renewable Natural Resources, University of Arizona, Tucson, AZ

Earl Jackson, Southwestern Parks and Monuments Association, Globe, AZ
National Audubon Society, Tucson, AZ
Sierra Club, Tucson, AZ
National Parks and Conservation Association
Southern Arizona Hiking Club
Arizona Sonora Desert Museum, Tucson, AZ.

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